

THE CONCEPTION OF "STRESS" AS
SUBMITTED BY HANS SELYE

An appraisalment

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SYNOPSIS

The results of Selye's research will play an important part in the development of psychosomatic (functional) medicine. But to one who has been engaged for many years in studying patients with Selye's so-called "the-just-to-be-ill syndrome", (Seyffarth 1946, 1960), Selye's conception of "Stress" seems strange and from a clinical point of view unsatisfactory. (Selye 1950, 1956). It can thus be argued whether all stress reactions should be termed "defence" because many of them are such, that from their early stages they have a tendency to injure the organism permanently. Selye defines "Stress" as: the state characterized by a specific syndrome called "the general adaptation syndrome" (G.A.S.). From an ordinary medical point of view, this syndrome may be divided into: a) Etiology, b) pathogenesis and c) pathological changes.

a. *Etiology*. G.A.S. may be caused by a series of so-called stress factors, amongst others, nervous tension, normal muscular activity, physical injury, infection, chills, heat, X-ray etc.

b. *Pathogenesis*. G.A.S. is the functional adaptability of the organism. This functional state of the organism is in itself "Stress", a conception Selye maintains is an abstraction. "Stress" does not include every form of functional adaptability of the organism. Only stress bringing about common unspecific changes in the organism (in glandulae suprarenales

etc.) is considered as stress, whereas specific changes, for instance antitoxins, are excluded.

c. *The pathological anatomical changes* are interpreted by Selye as the objective standard of the general adaptation syndrome (G.A.S.). The anatomical changes show that the adaptation syndrome has 3 stages.

1. The alarm stage, 2. The resisting stage, 3. The stage of exhaustion.

CRITICISM

1. *Local Stress*

Re a. *Etiology* (stress factors).

Selye supposes that all normal activities are to be considered as stress factors, i.e. they are to be regarded as withdrawals from a banking account opened at birth. This account he calls the energy of adaptability i.e. the energy independent of the calorific requirements necessary to "acquire" and retain the adaptation of the organism. To a certain degree this would appear to contradict his view that a quantity of stress is necessary in order to sustain the organism.

Selye's definition of stress factors is difficult to accept from a customary clinical therapeutic line of thought as we generally classify the functions of the organism as harmful to health or health promoting. While for inst. clinically it is taken for granted that in general muscular hypertrophy represents an activity beneficial to the organism, Selye presumes that such an activity also reflects factors of stress releasing local stress. From a clinical point of view we should, on the other hand, speak of a stress only if a female clerk, for instance, has overtaxed certain muscle groups as a result of a faulty working position. In this case the stress is caused, for inst. by a high desk compelling her to raise her shoulders.

Re b. *Pathogenesis*.

The reaction occurring in advance of the changes in the muscles is, according to Selye, "The stress reaction".

A neuro-physiologist will find it quite natural to say that the *primary* stress reaction consists of the *reaction of the nervous system* in connection with muscular activity. In the case of the above mentioned female clerk the primary response would be static muscle work, (shoulder kept raised).

On the other hand, Selye seems to think that stress reaction is not a primary reaction but a *secondary one*, appearing as a response to the primary reaction. Selye writes (1956, Chap. 7) that "Biological stress is chiefly a state of adaptation resulting from the creation of an state of antagonism between an assailant and the opposition proffered by the body".

Is it appropriate to interpret this secondary reaction as an independent one? Is it not more natural to see stress as a function co-ordinated with the primary reaction of the nervous system namely, as a link in the series of mechanism of adaptation set in motion when the organism is exposed to strain.

To take an example from the skeletal muscular system, we can imagine, a short leg (etiology) releases a series of adaptation of the posture of the body. In turn, the posture of the body will often influence the way of respiration. The adaptation of the pose is part of the body's primary opposition. It achieves its object if this is just to maintain the balance. But if the columna gets locked somewhere in the nape of the neck (occiput), it leads next to a painful disorder in the muscles and spine, causing among other things, headache. It is perhaps this secondary functional adaptation Selye has in mind when he comments on local stress. It is difficult to imagine a process (the stress reaction) which unaided will adapt itself to the demands of the organism in the manner Selye assumes. The organism's usual way of co-ordinating its functions seems to be that a function acting as stimulus compels other functions to adjust themselves. The reflexes, can be antagonistic so that the one has a restraining influence on the other. Sometimes they are allied.

Selye mentions, as an example of adaptation, that as time goes on one will acquire an increased co-ordination of move-

ment and a muscle hypertrophy limiting the use of muscles to a smaller area. But we regard such an adaptation as a health promoting reaction, *and it is therefore difficult to consider this beneficial function the same kind of stress as static muscle work* which leads to overstrain with the formation of muscular infiltrations (fibrositis), and possibly arthroses.

Re c. *The pathological anatomical changes.*

Selye seems to presume that all reactions released by stress are expedient in their early stages and have as their object to increase the defensive powers of the organism. It is difficult to accept this theory with regard to the changes in circulation etc., underlying the appearance of the muscular infiltrations. From the outset they must be considered as harmful (strain) and contributing to the further spreading of the stress reaction to other muscles.

This spreading takes place by a *circulus vitiosus* muscular infiltrations → increased weariness → increased exertion for the patient → increase in the prevalence of muscular infiltrations. When there are painful disorders in the skeletal muscular system, the doctor's task is as a rule, to intervene in the *circulus vitiosus* and make it move the other way round. We will then get a surplus of reparative forces. In this connection may be mentioned that it goes without saying that muscular infiltration must be an unspecific reaction, induced as it is by static muscle work and also *inter alia* by, a slight cooling down (not releasing a sufficient alarm reaction).

One reason why muscular infiltration can scarcely be considered as reflecting an adaptation is that they induce a feeling of weariness and pain which in turn may increase the state of irritation in large sections of the nervous system and thereby release a *general stress reaction*. According to Selye's terminology, muscular infiltration may be regarded as a consequence of an unfavourable local adaptation to stress.

2. General Stress

Let us now deal with those forms of stress releasing Selye's *general adaptation syndrome* (G.A.S.). This is defined as manifestations of stress in the whole body developing chronically in three distinct stages: 1. The alarm stage, 2. The resisting stage, 3. the stage of exhaustion.

The above mentioned definition seems logical to the point when we start out with Selye's most important empiric material, the inflammation occasioned by an injection of croton oil into an airbubble previously lodged in the back of a rat.

1. *The alarm stage* gives warning to the defence mechanism of the body which endeavours to confine the inflammation. At this stage the anti-inflammatory corticoides, among other things, are of great importance. By prevailing allergic reactions the alarm reaction is supposed to be too weak.

2. *The resisting stage*, where the intrusive stressfactors (the inflammation) are confined behind an abscess wall of connective tissue. At this stage there are few of the anti-inflammatory hormones to be found.

3. *The Stage of Exhaustion*. In this stage the organism has given up confining the inflammation and the infection is spreading all over the organism. In certain cases Selye regards this as an advantage as this "adaptation" hinders the occurrence of large local injuries. The hormone production again increases and may, at this stage, reach its maximum.

As a proof that the inflammation has released a general adaptation syndrome, one finds in rats: swollen glandula suprarenalis with small hemorrhages (sign of hypersecretion), retroformation of lymphoid by thymus and multiple bleeding stomach ulcers. The animal's weight decreases and there are changes in the body's chemical combinations.

If we leave the processes of inflammation and try to *apply this view to psychosomatic diseases*, we will encounter many difficulties.

Stressfactors are what Selye calls emotional stress. What is that? In the last chapter of his book 1956, he is dealing

with nervous tension which should be avoided in the company of other people. He is here in agreement with the clinical conception of stress in nervous persons. But there are several abstruse points. How is the concept "stressfactor" defined? Is it possible to suffer from a nervous tension which is not part of a complete reaction comprising psychosomatic functions? Does not the reaction of the endocrine glands belong to the complete reaction? And is not the cause of this reaction the stressfactor and not that part of the total reaction which he calls nervous tension?

The real etiological factor (stresses) in psychosomatic illnesses is primarily, as one may see it, a conflict, pressure of work, overstrain or pain. This factor causes stress only if the vulnerable person reacts by nervous tension (distress tension) which is a total reaction including greater or smaller parts of the entire nervous system with its effectors—organs—skeletal muscles—smooth muscles in the intestines and blood vessels, the skin glands, intestinal canal etc. From a clinical point of view, this reaction will also include the endocrine glands, and when Selye emphasizes that the hypophysis-suprarenal glands are a special defense mechanism, this seems out of place.

The axis hypophysis-suprarenal glands is scarcely an exceptional function, and ought to be regarded as a function closely connected with other functions, for inst., neuromuscular reflexes appearing when we are in danger. There is reason for regarding the corticoid production as a special function, when it acts as a reparative in contrast with the rest of the psychosomatic reactions. But this is a moot question.

From clinical experience we may in my opinion submit the following factors:

1. Etiological factor (conflict).
2. a. The general psychosomatic reaction (primary reaction to attack).
- b. The adaptation syndrome which probably forms part of the psychosomatic reaction, a., considered by Selye, however, as a secondary reaction.

Selye seems to think that by adding up 1 and 2 he will get the etiological factor (stress), just as he after uniting bacteria and inflammation, labels this combination stress. This lack of differentiation between the etiological factor and the primary response is rather unfortunate. By following Selye's line of thought we find that the primary psychosomatic reaction should not give cause to illnesses. Psychosomatic illnesses, he claims, are due to lack of adaptation, and he therefore calls them *adaptation illnesses*.

In case of illness, he thinks an inexpedient G.A.S. (general adaptation syndrome) is to be found, too great or too small quantities (or an unfavourable mixture) of adaptative hormones. (Inflammatory and anti-inflammatory hormones).

But in spite of this unfavourable production of hormones, he interprete it as primarily expedient (life promoting). It this really so? Selye says that G.A.S. is a specific syndrome brought about by unspecific reasons. *Is G.A.S. really so specific?* Does it not vary with the nature of the stress factors? It seems reasonable enough that the adaptation syndrome is quite expedient in cases where the applied stress-factor are chills, and bacteriological infection. All these stress factors are recognizable through their releasing a certain reaction comparable with actions, fights or escape. But are not conditions different with conflicts characterized by lack of outlet?

When Selye claims that all tension prepares an increased effort (the alarm stage), this is quite acceptable whenever there is question of tension prior to a certain task, such as in, hunting or in sport. This is a *healthy tension* induced by a need due to instincts and impulses, a part of the instinct of self-preservation and to the fact that the person concerned knows he is going to fight.

This healthy tension is different from the tension in nervous persons seized by fear, a feeling for which they find no outlet. In a nervously strained person there is no outlet in action. On the contrary it is this *lack of relief in action* which occasions the psychosomat reaction. In this case one can scarcely

expect a co-ordinated reaction on the part of the organism, as when the reaction on a stimulus dominates.

Would it not be reasonable then to suppose that the adaptation hormones released under nervous strain are of another nature? Primarily they must be life-restrictive, similar to the simultaneous neuro-muscular functions. Such situations as paralysed by fright, nervousness at examinations in school, or the employees scarcely able to walk up stairs to see their angry chief on account of their respiration neurosis etc.

If we accept a difference in the hormone production by healthy tension, (relieved in action) and by nervous tension locking all functions (among other things through static muscle work), we will be more able to explain the fact that injuries sustained on the sports ground cause less disablement than accidents at work.

In his book (1956) Selye mentions certain circumstances which go to show that the hormone production may vary with the different kinds of stress. The Swedish investigator, Carstensen, has discovered that there "is a definite form of hypophysis hormone" working successfully in pulmonary tuberculosis. It is therefore permissible to suppose that this form of pituitary hormone may be the cause of that temporary flourishing state witnessed in a tuberculosis patient who has fallen in love, (Selye mentions that a kiss may also be a form of stress). Correspondingly pathological changes in the cells tend to confirm the profound truth of the old adage: "One can die from unhappy love". (Leiv Kreyberg's personal commentary).

In his research on bleeding ulcers, the American investigator, Seymour J. Grey (Selye 1956) discovered that it is the surplus of enzymes which increases the digestive function. But this corresponds fairly well to an increase in the pro-inflammatory hormones. As is known in cases of polyarthritis there is an increased output of anti-inflammatory hormones.

That, there is a difference between the healthy tension (fight, escape) and the life-restrictive tension of anxiety is more in accordance with the observations by H. G. Wolff

(1953) and *Cannon* (1939). Wolff maintains that an increase in blood pressure, caused by stress is due to contraction of the blood vessels, while in the case of fight or escape, dilatation of the blood vessel takes place and the blood pressure increases because the heart's minute volume is increased. Clinical observations also indicate that normal muscular activity (manual labour) counteracts a tendency to heart infarct, therefore that muscular activity has a anti-stress effect.

Selye's opinion that G.A.S. is specific may be due to his observed material. He dissected animals after they had been, bound to a table. Selye writes that they were struggling all the time to free themselves. Here the stress-factor releases a fight, probably accompanied by a healthy tension. At the same time we may suppose that the animal is seized by anxiety simultaneously producing an unhealthy tension. If a more definite result is to be obtained, one should produce nervousness in animals, as Pavlov did with his conditioned reflexes, whereby the signals became eventually so similar that the animals did now know how to act and consequently stiffened in a tension of fear.

In order to produce a healthy tension, Selye used the treadmill. But animals will not be allowed to run until completely exhausted. Strain in every form may be harmful when there is too much of it, just as water may "poison" if a person is forced to drink too much of it. It is the difficulty in finding the right degree of stimulus, the balance between the beneficial and the harmful influence which renders the psychical treatment of psychosomatic diseases in the skeletal muscular system so complicated.

We must admit that there is no sharp distinction between the injurious functions and the reparative ones. As an example may be mentioned that static muscular work (manual work) may be beneficial to the organism as a whole, as in the tightening of the lumbar spinal cords by lifting. Maximum static contractions of short duration are also used to improve local muscular strength. But clinical experience tends to show that the protracted, feeble and static manual work such as is car-

ried out by typists (*Seyffarth* 1950) will, in most cases, occasion muscular infiltrations. On the contrary, the static muscular work produced by nervous strain tension of anxiety appears, always to have a damaging effect on the muscles (muscular infiltrations and contractures?) (*Seyffarth* nr. 2 1956). The force and duration of the stimulus seems to produce different kinds of reaction.

In conclusion one would like to say that this appraisal is made in spite of the fact that my admiration for Selye's personality revealed through his book (1956) is very great. In the last part of the book he gives much good advice in order to help mankind. Personally he watches himself, and by introspection he endeavours to expose the situations in which he feels nervous tension and acts accordingly.

But why not practice conscious relaxation in order to subdue the nervous tension? Relaxation is a function which we all apply unconsciously, activating the inhibitory system. In specially gifted persons we may presume that, this inhibition during a conflict also spreads to greater parts of the nervous system. But for the majority of people a voluntary exercising of this "defence mechanism" will be an excellent aid in the struggle to maintain their psychosomatic harmony.

By this appraisal of the concept of stress, the impression might be that it has somewhat missed with the criticism the main trend of Selye's idea, which is to find a uniform principle for the organism. On this point one is unable to follow his chain of reasoning. The hope is, however, that these suggestions may be of use when in future papers, he combines his many valuable observations and clinical experience.

CONCLUSION

1. In *local stress*, in the skeletal muscular system, there is *hardly a particular* adaptation mechanism which by nature is curative, but a function co-ordinated with the rest of the defence reactions of the organism. Muscular infiltrations is supposedly the outcome of an "adaptation" to static manual

work, which is harmful at the very beginning. Dynamic muscular action is a health promoting function, and can scarcely be considered an etiological stress factor. Even if a stimulus is beneficial at first, it may be transformed into a stress factor by increasing its force and operative time sufficiently.

2. In Selye's paper the etiological factor is a uniting of two factors, such as, bacteria and the consequent inflammation which is the primary reaction of the organism. Correspondingly "emotional stress" which Selye regards as an etiological factor is also mentioned. One should rather divide "emotional stress" into: a. conflict and b. the reaction it may produce.

3. Selye maintains that Stress is an adaptative state which is secondary in relation to nervous tension (psychomotor tension). It is more natural to think that *Selye's stress reaction* (which starts hormone production and permanent changes in the suprarenal glands, the stomach etc.) *is part of that nervous reaction* (psychosomatic) generally leading to psychosomatic diseases. To pick out the hormone reaction as a defence reaction separated from all other functional changes occurring in a person under different stresses, appears far-fetched.

4. The balance between the different functions is hardly attained by one particular adaptation process, but by means of reciprocal influences following the same pattern as, in the sinew-reflexes.

5. The author is of opinion that there should be a differentiation between stressfactors which can be relieved by a single response (healthy tension) and the stress factors which are a consequence of unsolved conflicts wherein all functions have a tendency to get locked in a psychomotorical tension (tension of anxiety).

6. The stress reaction is scarcely specific, but is supposedly varying according to different kinds of stress factors.

One may thus presume that the general stress reaction releases a form of hormone production which varies according to whether the stress factors occasion a healthy or an unhealthy tension.

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